

CLAIMS

What is claimed is:

1. A fuel cell system comprising:
 - a fluid tight enclosure having an outlet;
 - at least one fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, said fuel cell being located in said enclosure;
 - a hydrogen sensor operable to detect the presence of hydrogen, said hydrogen sensor being positioned in a vicinity of said outlet of said enclosure; and
 - a ventilation stream flowing through said enclosure and exiting said enclosure through said outlet, said ventilation stream continuously flowing through said enclosure while said fuel cell is operating.
2. The fuel cell system of claim 1, further comprising a compressor operable to supply said oxidant gas to said fuel cell and to induce flow of said ventilation stream.

3. The fuel cell system of claim 2, wherein said enclosure includes an inlet through which said ventilation stream enters said enclosure, said outlet of said enclosure is in fluid communication with an inlet of said compressor, and said compressor draws said ventilation stream from said inlet of said enclosure through said enclosure and outlet and into said compressor.
4. The fuel cell system of claim 2, wherein a portion of a cathode effluent produced by said fuel cell is discharged into said enclosure and forms at least a part of said ventilation stream.
5. The fuel cell system of claim 4, wherein essentially all of said cathode effluent is discharged into said enclosure.
6. The fuel cell system of 1, wherein said hydrogen sensor includes:
a catalytic combustion element operable to consume hydrogen; and
a temperature sensor operable to detect a change in temperature.
7. The fuel cell system of claim 6, wherein essentially all of said ventilation stream flows through said catalytic combustion element.
8. The fuel cell system of claim 7, wherein said hydrogen sensor simultaneously detects and consumes hydrogen.

9. The system of claim 1, further comprising a hydrogen-containing test stream, said test stream being selectively added to said enclosure to test operation of said hydrogen sensor.

10. A fuel cell system comprising:
 - an enclosure having an outlet;
 - at least one fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, said fuel cell being located in said enclosure;
 - a ventilation stream operable to flow through said enclosure and exit said enclosure through said outlet;
 - a hydrogen sensor operable to detect the presence of hydrogen, said hydrogen sensor being positioned in a vicinity of said outlet of said enclosure, and said hydrogen sensor including a catalytic combustion element operable to react hydrogen.
11. The fuel cell system of claim 10, wherein said hydrogen sensor further includes a temperature sensor operable to detect a change in temperature as a result of hydrogen reacting in the presence of said catalytic combustion element.
12. The fuel cell system of claim 11, wherein said temperature sensor is a thermocouple.
13. The fuel cell system of claim 11, wherein said temperature sensor is a strain gage having a resistance that changes with a change in temperature.

14. The fuel cell system of claim 11, wherein said temperature sensor includes a shape memory alloy.

15. The fuel cell system of claim 10, wherein essentially all of said ventilation stream flows through said catalytic combustion element prior to exiting said enclosure.

16. A fuel cell system comprising:
- an enclosure having an outlet;
 - at least one fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, said fuel cell being located in said enclosure;
 - a coolant reservoir operable to hold coolant used to extract thermal energy from said fuel cell, said coolant reservoir being located in said enclosure;
 - a hydrogen sensor positioned in said enclosure, said hydrogen sensor being operable to detect the presence of hydrogen;
 - a ventilation stream flowing through said enclosure and exiting said enclosure through said outlet; and
 - wherein at least a portion of said ventilation stream flows through said coolant reservoir prior to exiting said enclosure.

17. The fuel cell system of claim 16, wherein said coolant reservoir comprises a gas separator operable to separate gas from said coolant.

18. The fuel cell system of Claim 16, wherein said ventilation stream is in direct contact with said coolant in said reservoir.

19. A method of operating a fuel cell system wherein the fuel cell system includes a fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, the fuel cell being located in an enclosure having a hydrogen sensor positioned in the enclosure, the method comprising:

- (a) selectively operating the fuel cell to generate power;
- (b) supplying a continuous ventilation stream through the enclosure during operation of the fuel cell;
- (c) detecting a presence of hydrogen in the ventilation stream with the hydrogen sensor; and
- (d) discontinuing the supplying of said ventilation stream when the fuel cell is not being operated.

20. The method of claim 19, wherein (b) includes inducing a flow of said ventilation stream with a compressor operable to supply the oxidant gas to the fuel cell and to induce flow of said ventilation stream.

21. A method of operating a fuel cell system wherein the fuel cell system includes a fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, the fuel cell being located in an enclosure and the oxidant gas being supplied to the fuel cell with a compressor, the method comprising:

- (a) selectively operating the fuel cell to generate power; and
- (b) inducing a ventilation stream to flow through the enclosure with the compressor.

22. The method of claim 21, wherein (b) includes routing a portion of a cathode effluent produced in the fuel cell through the enclosure.

23. The method of claim 21, wherein an inlet of the compressor is in fluid communication with the enclosure and (b) includes drawing said ventilation stream through the enclosure and into the compressor.

24. The method of claim 21, wherein the fuel cell system has a hydrogen sensor positioned in the enclosure and the method further comprises detecting a presence of hydrogen in said ventilation stream with the hydrogen sensor.

25. The method of claim 21, wherein (b) is performed only while the fuel cell is being operated to generate power.

26. A method of operating a fuel cell system wherein the fuel cell system includes a fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, the fuel cell being located in an enclosure having a hydrogen sensor positioned in the enclosure, the method comprising selectively supplying a hydrogen-containing test stream to the enclosure to test the operation of the hydrogen sensor.

27. The method of claim 26, wherein supplying said test stream is done at predetermined intervals.

28. The method of claim 27, wherein said predetermined interval is based on an accumulated duration of operation of the fuel cell.

29. The method of claim 27, wherein said predetermined interval is based on a time interval.

30. The method of claim 26, wherein supplying said test stream includes routing a portion of a hydrogen-containing gas stream that is operable to supply the hydrogen-containing gas to the fuel cell to the enclosure.

31. A method of operating a fuel cell system wherein the fuel cell system includes a fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, the fuel cell being located in an enclosure having a hydrogen sensor positioned in the enclosure, the method comprising:

- (a) selectively operating the fuel cell to generate power;
- (b) ventilating the enclosure with a ventilation stream during operation of the fuel cell;
- (c) detecting a presence of hydrogen in the ventilation stream with the hydrogen sensor; and
- (d) consuming detected hydrogen with the hydrogen sensor.

32. The method of claim 31, further comprising performing (c) and (d) substantially simultaneously.

33. The method of claim 31, wherein the hydrogen sensor includes a catalytic combustion element and (d) includes catalytically combusting detected hydrogen.

34. A method of operating a fuel cell system wherein the fuel cell system includes a fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases and a coolant reservoir operable to store a coolant that is used to extract thermal energy from the fuel cell, the fuel cell and coolant reservoir being located in an enclosure, the method comprising:

- (a) selectively operating the fuel cell to generate power;
- (b) ventilating the enclosure during operation of the fuel cell with a ventilation stream; and
- (c) routing a portion of said ventilation stream through the coolant reservoir.

35. The method of claim 34, wherein the fuel cell system includes a hydrogen sensor operable to detect the presence of hydrogen in said ventilation stream, the sensor being positioned in the enclosure and wherein the method further comprises detecting a presence of hydrogen in said ventilation stream with the hydrogen sensor.

36. The method of claim 34, wherein the fuel cell system includes a compressor operable to supply the oxidant gas to the fuel cell and further comprising inducing said ventilation stream to flow through the enclosure with the compressor.

37. A method of operating a fuel cell system to detect a hydrogen leak wherein the fuel cell system includes a fuel cell operable to generate power using hydrogen-containing gas and oxidant gas as reaction gases, the fuel cell being located in an enclosure having a hydrogen sensor positioned in the enclosure, the method comprising:

- (a) selectively operating the fuel cell to generate power;
- (b) ventilating the enclosure during operation of the fuel cell with a ventilation stream; and
- (c) detecting a presence of hydrogen in said ventilation stream with the hydrogen sensor by monitoring a temperature.

38. The method of claim 37, wherein (c) includes monitoring a temperature of said ventilation stream.

39. The method of claim 37, wherein the hydrogen sensor includes a catalytic element and (c) includes monitoring a temperature of said catalytic element.

40. The method of claim 37, wherein (c) includes catalytically reacting hydrogen in said ventilation stream with the hydrogen sensor.

41. The method of claim 37, further comprising routing at least a portion of said ventilation stream through the hydrogen sensor.

42. The method of claim 41, further comprising routing an entire portion of said ventilation stream through the hydrogen sensor.

43. The method of claim 37, wherein (b) includes continuously venting the enclosure with said ventilation stream during operation of the fuel cell.

44. The method of claim 37, wherein the fuel cell system includes a compressor operable supply the oxidant gas to the fuel cell and wherein (b) includes inducing said ventilation stream to flow through the enclosure with the compressor.